Microbiological Quality of Pork Meat from Local Mammy Market in Niger State, Nigeria

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Abstract

Over a 3-week period, samples of fresh, chopped, pork meat were purchased every morning and afternoon. Microbiological examination revealed that the samples had colony forming unit per gram, (cfu/g): mean bacteria load 47.0 – 82.5 x 10^5 in the morning and 72.3 – 110.6 x 10^5 in the afternoon. Bacterial pathogens include Staphylococcus aureus, Escherichia coli, species of Salmonella, Shigella and Bacillus. The fungal isolates include Aspergillus niger, Aspergillus flavus, Aspergillus fumigatus and species of Mucor and Fusarium. Because microbial growth and/or contamination of the meat occurred during the day, samples taken in the afternoon had greater total counts (P<0.05) than those taken in the morning.

Keywords: Mammy Market, Microbial Quality, Bacillus spp, Pork meat.

Introduction

When carcasses leave an abattoir they are invariably contaminated with bacteria during the distribution of meat to the consumer, the storage conditions for the meat at the retailer’s stall or shop may promote an increase in bacterial numbers on the meat. This increase can simply arise because the natural microflora on the meat grow but the environment, utensils and benches used to butches the carcass can also heavily contaminate the meat if hygiene is poor (O’Toole 1995).

Apart from the possibility of microbial spoilage, meat at the point of sale may carry disease causing bacteria whose mere presence is of concern because the meat then becomes the vehicle for food poisoning outbreaks. At the March, 1993 meeting of Codex Alimentarius in Rome, for example, it was proposed that meat contaminated with Salmonella be condemned as unfit for human consumption, although this proposal was not adopted (Anon. 1994). Nearly 100 million metric tons of pork was consumed worldwide in 2006 (USDA 2007). The purpose of the present study was to examine the microbiological quality of pork offered for sale in Mammy market in Nigeria and to determine if microbial loads increased on the meat during the day.

Materials and Methods

Stalls in Mammy Market were chosen at random and samples were purchased in the morning and afternoon. Samples were purchased on each day over 3 weeks. A total of 80 samples were purchased, and each sampled twice. The ambient temperature at the time of sampling was 30 to 32°C.

Sampling Collection

Each sample was of 0.5kg pork, chopped by the butcher and treated as any food purchased by a consumer. Samples were placed in a normal shopping bag (polythene) and taken to the laboratory for analysis.

Microbiological Counts

Twenty-five gram sub-sample of meat was blended vigorously for 1min in 225ml sterile 0.1% peptone/water using a food blender. Dilutions of this homogenate were used to determine microbial counts.
**Total Aerobic Count**

Development or growth colonies were counted using colony counter expressed as colony forming unit per gram, of meat (cfu/g).

**Coliforms and E. coli Count**

Coliforms and Escherichia coli were estimated using MacConkey broth and the multiple tube dilution method to determine the mean probable number. Incubation of the tubes was at 30°C for up to 48h and all positive; gas producing tubes were checked and confirmed for the presence of E. coli by growth on Eosin Methylene Blue Agar (EMBA).

**Moulds Count**

Moulds were counted on sabouraud dextrose agar (Oxoid) with added chloramphenicol, after incubation at 25°C for up to 5 days.

**Staphylococcus aureus Count**

Staphylococcus aureus were counted on manitol/salts agar (Oxoid) and confirmed as coagulase – positive by tube test and slide test Cheesbrough (2002).

**Statistical analysis**

To determine if microbial numbers had increased during the day, morning and afternoon values for each stall were compared using paired samples testing by rank (Zar 1984).

**Salmonella Count**

A 25-g sub-sample was pre-enriched in 225ml sterile 0.1% peptone/water at 37°C for 18 to 24h. 10ml pre-enriched broth were added to 10ml double-strength selenite-F broth (oxoid) and incubated overnight at 37°C and a loopful was then streaked onto Salmonella-Shigella agar (Oxoid) and again incubated at 37°C overnight. Positive salmonella colonies were identified as black colonies.

**Results and Discussion**

**Total Aerobic Count**

The results (Table 1) show that the average total aerobic count of micro-organism for the 80 samples in the morning range from 47.0 x 10^5 to 82.5 x 10^5 cfu/g while in the afternoon the range was from 72.3 x 10^5 to 11.6 x 10^6. There was wide variation in the counts between stalls. The morning samples had significantly lower total aerobic counts than the afternoon samples (P<0.05). The corresponding differences in the counts of other organisms were not significant. This is in agreement with the work of O’Toole (1995), who found lower total aerobic counts in the morning samples, the increase in total aerobic count was probably due to growth as both (about 30°C) ambient temperature (about 30°C) and relative humidity (usually >90%) were high enough to favour bacterial growth on meat (Gardner 1982).

If high numbers of bacteria are already present on some of the meat at the beginning of the day, this will lead to contamination of the utensils and benches of the meat stall and subsequently newly delivered carcasses and newly butchered meat.

The presence of E. coli can cause serious food borne disease, particularly E. coli 0157:H7, but we did not test for this strain in the meat. The total average of S.aureus ranges from 36.7 x 10^5 – 7 0.5 x 10^5 cfu/g in the morning to 44.00 x 10^5 – 80.2 x 10^5 cfu/g in the afternoon. Staphylococcus aureus are commonly found in humans and other diseases, as the result of growth on meat (Brown and Baird-Parker 1982). Their presence in the present samples was probably due to human contact.

The mean count of fungi (mould) in the morning ranged from 2.5 x 10^5 to 4.7 x 10^4 cfu/g and afternoon ranged from 5.1 x 10^5 to 7.2 x 10^4 cfu/g respectively. Moulds counts are generally regarded as an indicator of the general hygiene of the environment. Growth occurs in difficult – to – clean places from which food scraps and juices are not properly washed away. High counts indicate that there
are places that have not been cleaned properly for a long time. The differences between morning and afternoon count was not statistically significant, butchering activity during the day probably helped to remove some of these organisms from the surfaces that are easily accessible.

The total average Salmonella count in the morning ranged from $1.6 \times 10^5$ to $7.5 \times 10^4$ cfu/g and afternoon count ranged from $1.5 \times 10^3$ to $7.5 \times 10^4$ cfu/g. The 15% incidence of Salmonella on the pork generally increased during the day. The incidence of Salmonella in Mammy Market samples can be compared with survey conducted on similar pork products in other countries (D’Aoust 1989); Salmonella incidence in minced beef and/or pork samples was 1.8% in 112 samples from the USA, 20.0% in 1839 samples from England, 5.3% in 322 German samples, and 20.0% in just 25 Canadian samples. It is likely that the Salmonella detected in pork from Mammy Market were on carcasses when they were delivered.

However, the increase in incidence between morning and afternoon samples indicates that conditions in the stalls promote an increase in Salmonella on the meat during the day, with the high temperature, poor handling practices and general contamination from the environment all contributing. The ecology and distribution of Salmonella in the markets including the role of the carcasses remain to be elucidated.

### Conclusion

The results show that pork meat from meat stalls in Local Mammy Market is potentially hazardous and that the meat from some meat stalls may be more hazardous than that from others due to poor hygiene. Procedure to reduce Salmonella in pork in Mammy Market should be investigated and instigated.

### Acknowledgment

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### Table 1. Average microbial count.

<table>
<thead>
<tr>
<th>Media</th>
<th>Morning (cfu/g)</th>
<th>Afternoon (cfu/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>$47.0-82.5 \times 10^2$</td>
<td>$72.3 - 11.6 \times 10^3$</td>
</tr>
<tr>
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<td>$36.7-70.5 \times 10^3$</td>
<td>$44.0 - 80.2 \times 10^3$</td>
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</tr>
<tr>
<td>SDA</td>
<td>$2.5 - 4.7 \times 10^4$</td>
<td>$5.1 - 7.2 \times 10^4$</td>
</tr>
</tbody>
</table>

Key:
- NA Nutrient agar;
- MSA Mannitol salt agar;
- SSA Salmonella shigella agar;
- SDA Sabouraud dextrose agar;

Cfu/g Colony forming unit per gram.

### References


